

REMARKS

Applicant requests favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 1, 2 and 4-11 are presented for consideration. Claim 1 is the sole independent claim. Claims 1, 2 and 8-10 have been amended to clarify features of the subject invention. Support for these changes can be found in the original application, as filed. Therefore, no new matter has been added.

Applicant requests favorable reconsideration and withdrawal of the rejections set forth in the above-noted Office Action.

Claims 1, 2, 4, 5 and 11 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 4,952,945 to Hikima in view of Japanese patent document number 11-298083 to Tanaka et al. Claims 6-10 were rejected under 35 U.S.C. § 103 as being unpatentable over the Hikima patent in view of the Tanaka et al. document as applied to claim 1, and further in view of U.S. Patent No. 5,170,207 to Tezuka et al. Applicant submits that the cited art, whether taken individually or in combination, does not teach or suggest many features of the present invention as previously recited in independent claim 1. Therefore, these rejections are respectfully traversed. Nevertheless, Applicant submits that the cited art does not teach many features of the present invention, as recited in independent claim 1, as presented.

Independent claim 1 recites a projection exposure apparatus including a continuous emission excimer laser, having a resonator, for providing laser light, an illumination optical system for receiving the laser light from the continuous emission excimer laser and for

illuminating a pattern of a reticle with the laser light, a projection optical system, including a lens system made of a substantially single glass material, for projecting the illuminated pattern of the reticle onto a substrate, an injection laser for injecting light into the resonator of the continuous emission excimer laser, wherein a design wavelength of the injection laser is equal to a design wavelength of the continuous emission excimer laser, a wavemeter for measuring the wavelength of the laser light from the continuous emission excimer laser and for producing a signal, and changing means for changing a resonator length of the continuous emission excimer laser on the basis of the signal from the wavemeter so that the wavelength of the laser light from the continuous emission excimer laser becomes equal to the design wavelength of the continuous emission excimer laser.

Accordingly, the present invention recited in independent claim 1 is directed to an exposure apparatus that includes an injecting laser and a laser (such as a continuous emission excimer laser) to be injected thereby. Of these lasers, the continuous emission excimer laser is provided in combination with a wavemeter and resonator length changing means.

Generally speaking, continuous emission excimer lasers have a problem that the emission wavelength is so easily variable that it often deviates from the design wavelength, quite readily. In consideration of this, in accordance with the present invention, not only is the injection laser added for the continuous emission excimer laser, but also, the continuous emission excimer laser itself is provided with a wavemeter and resonator length changing means. Such an arrangement is quite effective in controlling the emission wavelength of the continuous emission excimer laser to its design wavelength, constantly, during the emission. As a result of this arrangement,

in the exposure apparatus of the present invention, unwanted variations in optical characteristics due to changes in the wavelength of the continuous emission excimer laser can be significantly reduced, such that the pattern of a reticle can be transferred to a substrate more accurately.

In the exposure apparatus of the present invention, the wavemeter and the resonator length changing means are provided in relation to the continuous emission excimer laser, and not in relation to the injection laser. Therefore, even if injection locking by the injection laser is discontinued, the center wavelength of the laser light output from the continuous emission excimer laser can be maintained constant.

Applicant submits that the cited art, whether taken individually or in combination, does not teach or suggest such features of the present invention, as recited in independent claim 1.

The Hikima patent shows a wavelength monitor 200 for detecting laser light from an excimer laser 100, and an etalon 104 whose tilt angle can be changed to control the wavelength. This etalon 104 is, however, merely a wavelength selecting element. Thus, even by tilting the etalon, it is absolutely not possible to change the resonator length, in the manner of the resonator length changing means of the present invention recited in independent claim 1.

Still further, the Hikima patent does not mention anything regarding injection locking. Naturally, therefore, the Hikima patent is completely silent as to the use of a wavemeter and a resonator length changing means provided in relation to a continuous emission excimer laser (injected laser), in the manner of the present invention recited in independent claim 1.

As noted above, the Hikima patent fails to teach a wavemeter for detecting the wavelength of laser light from a laser beam injected, or means for changing resonator length of a

laser being injected, in the manner of the present recited in independent claim 1. Accordingly, that patent fails to teach many features of the present invention, as recited in independent claim 1.

Applicant submits that the remaining art cited does not cure the deficiencies noted above with respect to the Hikima patent.

The Tanaka et al. document shows an injection locking laser system wherein, by changing a resonator length of an oscillation laser (injecting laser) A, the wavelength of laser light is controlled, and it is input into an amplifying laser (laser to be injected) B. In the laser system of the Tanaka et al. document, however, that which determines the wavelength of the laser light of the injection locking laser is the light from the oscillating laser (injecting laser) A. Such an arrangement as is presented in the Tanaka et al. document is quite conventional. Generally speaking, in injection locking laser systems, as in the Tanaka et al. document, the wavelength of the laser is determined by the injecting laser, so that a wavemeter and a resonator length changing device are provided in relation to the injecting laser.

Applicant submits, however, that the Tanaka et al. document is completely silent regarding providing a wavemeter for detecting a wavelength of laser light from a laser being injected or means for changing a resonator length of the laser being injected, in the manner of the present invention recited in independent claim 1.

The Examiner relies on the Tezuka et al. patent for teaching that particular lasers are well known, with ArF lasers inherently including lasers wherein a half bandwidth of wavelength spectrum of the laser light is not greater than 0.1 pm, which allows an image having a linewidth

of 0.13 μm . The Examiner also relies on the Tezuka et al. patent for teaching the use of other types of lasers having other types of bandwidths, which provide particular linewidths. Applicant submits, however, that the Tezuka et al. document, as with the Tanaka et al. patent, does not teach or suggest the salient features of Applicant's present invention, as recited in independent claim 1, which have been discussed above.

For the reasons noted, Applicant submits that the Tanaka et al. document and the Tezuka et al. patent add nothing to the teachings of the Hikima patent that would render obvious Applicant's present invention, as recited in independent claim 1.

For the foregoing reasons, Applicant submits that the present invention, as recited in independent claim 1, is patentably defined over the cited art.

Dependent claims 2 and 4-11 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in independent claim 1. Further individual consideration of these dependent claims is requested.

Applicant further submits that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Steven E. Warner", is written over a horizontal line.

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